Savannah River Site
Solid Waste Management Department
Consolidated Incinerator Facility
Operator Training Program

INCINERATOR FUEL OIL AND PROPANE IGNITION SYSTEMS (U)

Study Guide

ZIOITX25.02

Revision 01

_____
Training Manager/ Date

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Facility Manager/ Date

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REVISION LOG

REV.	AFFECTED SECTION(S)	SUMMARY OF CHANGE
00	All	New issue
01	All	New format, new material

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4. 261-SOP-FO-02, *Fuel Oil Storage Tank*, Rev. 6
5. 261-SOP-MST-01, *Main Steam and Condensate*, Rev. 3
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7. Incineration (DA H264) Functional Description, Rev. A(U)
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9. Operations and Maintenance Manual for Rotary Kiln Incineration System
10. WSRC-SA-17, *Consolidated Incineration Facility Safety Analysis Report*, DOE Approval Copy
11. ZIOISX20, Incinerator Fuel Oil System Design Description Rev. 0
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LEARNING OBJECTIVES

TERMINAL OBJECTIVE

1.00 Given the necessary procedures and references, **OPERATE** the Incinerator Fuel Oil and Propane Ignition Systems to support the safe, efficient control of the Consolidated Incineration Facility (CIF).

ENABLING LEARNING OBJECTIVE

1.01 **STATE** the purpose of the Incinerator Fuel Oil and Propane Ignition Systems at the CIF.

1.02 **STATE** the hazards associated with the Incinerator Fuel Oil and Propane Ignition Systems.

1.03 **SKETCH** the flowpath of the Incinerator Fuel Oil and Propane Ignition Systems to include:

a. Fuel oil feed pumps flowpath
b. RK local skid
c. SCC local skid
d. RK remote skid
e. SCC remote skid

1.04 **DESCRIBE** the type and purpose of the equipment utilized in the Incinerator Fuel Oil System to include:

a. Fuel oil unloading pump
b. Fuel oil storage tank
c. Fuel oil feed pumps
d. Fuel oil transfer pump
e. Strainers and filters
f. Pressure regulating valve
g. Flow control valves
h. Safety shutoff valves
i. Burners

1.05 **DESCRIBE** the type and purpose of the equipment utilized in the Propane Ignition System to include:

a. Propane Storage Tank
b. Pressure regulating valves
c. Solenoid valves
d. Propane pilots
e. Pilot ignitors

1.06 **DESCRIBE** the instrumentation used for monitoring the incinerator fuel oil system equipment operation to include:

a. Unloading pump
b. Storage tank
c. Feed pumps
d. Transfer pump
e. Filters/strainers

1.07 **DESCRIBE** the instrumentation used for monitoring the Propane Ignition System to include:

a. Propane Storage Tank
b. Remote RK and SCC burner skids
c. Local RK and SCC burner skids
d. Burner guns

1.08 **DESCRIBE** the controls associated with the operation of the Incinerator Fuel Oil And Propane Ignition Systems to include:

a. RK fuel oil flow
b. Fuel oil unloading pump
c. Fuel oil transfer pump
d. Fuel oil feed pumps
e. SCC fuel oil flow

1.09 **EXPLAIN** the operation of the interlocks associated with the Incinerator Fuel Oil and Propane Ignition Systems to include the interlock actuating conditions and effects, and reasons for the interlocks.

1.10 **EXPLAIN** how the Incinerator Fuel Oil and Propane Ignition Systems interrelate with the following equipment/systems:

a. Rotary Kiln
b. Secondary Combustion Chamber
c. Steam System
d. Distributive Control System and Burner Management System
e. Tank Farm
f. Instrument Air System
g. Nitrogen System

1.11 **DESCRIBE** normal operations of the Incinerator Fuel Oil and Propane Ignitions Systems to include:

a. Startup
b. Rotary Kiln
c. Secondary Combustion Chamber
d. Normal shutdown
e. Mandatory shutdown

1.12 **EXPLAIN** the consequences of abnormal operations associated with the Incinerator Fuel Oil and Propane Ignitions Systems.

1.13 Given a scenario illustrating a failure of one or more support systems associated with the Incinerator Fuel Oil and Propane Ignition Systems, **DETERMINE** the impact on the system operations, and **DESCRIBE** responses and mitigating actions.

1.14 Given a set of parameters, **CALCULATE** to find the following parameters:
a. Gallons pumped
b. Flowrate
c. Time

1.15 Given a Piping and Instrument Diagram (P&ID) and appropriate section of the setpoint document, **DETERMINE** the setpoint of a component using Component Location Identifier (CLI) numbers.

SYSTEM OVERVIEW

Safety

All personnel should be aware of the importance of safety. To prevent any mishaps from occurring, personnel should follow the guidelines set forth in WSRC 4Q, *Industrial Safety Manual* and WSRC 8Q, *Employee Safety Manual*.

ELO 1.02	**STATE the hazards associated with the Incinerator Fuel Oil and Propane Ignition Systems.**

Hazards

The hazards associated with the Incinerator Fuel Oil and Propane Ignition Systems include flammability, explosion, asphyxiation possibilities, and frostbite due to liquid propane's low temperature (during depressurization). Common sense should be used when working with the pressurized propane storage tank. The No. 2 fuel oil presents a flammability, explosion, and slipping hazard. Prolonged contact with No. 2 Fuel oil could cause skin irritation. Since both propane and No. 2 fuel oil pose a flammability hazard, no spark or flame is allowed within 50 ft of the area in which fuel oil or propane is present.

Introduction

The Incinerator Fuel Oil System is designed to supply No. 2 fuel oil to the fuel oil burners in the Rotary Kiln (RK) and the Secondary Combustion Chamber (SCC). The fuel oil is burned to control temperatures within the desired ranges to achieve the required waste destruction and removal efficiency (DRE). Fuel oil can also be blended in the blend tanks as necessary to increase the BTU content, or supplied to hose flush stations. The Propane Ignition Systems provides propane for the pilots associated with each waste/fuel oil burner. These pilots are used to ignite the Blended Waste/fuel oil in the RK and Radioactive Organic Waste/fuel oil in the SCC. The propane pilots are ignited by electrical spark ignitors.

Summary

- The Incinerator Fuel Oil and Propane Ignition System supply No. 2 fuel and propane to the RK and SCC Burners. Propane is used for burner ignition, and fuel oil is used to maintain combustion and the RK and SCC temperatures.

- Fuel oil and propane each have hazards associated with them. Operators should be aware of these hazards and comply with policies dealing with these hazards to avoid personal injury and any adverse effects.

SYSTEM PURPOSE

ELO 1.01 STATE the purpose of the Incinerator Fuel Oil and Propane Ignition Systems at the CIF.

Incinerator Fuel Oil System

The Incinerator Fuel Oil (FO) System is primarily used to bring the incinerator up to operating temperature. Once at temperature, the FO maintains the RK and the SCC temperatures within limits during the process of waste incineration. The FO System supplies No. 2 fuel oil to one burner in the RK and one burner in the SCC. The Distributed Control System (DCS) in conjunction with the Burner Management System (BMS) controls the firing rate of the FO Burners to maintain the required operating temperatures for the RK and the SCC. The FO can also be used for flushing of piping systems and blending with various waste streams.

Propane Ignition System

The Propane Ignition System provides for the initial ignition of the FO, Blended Waste and Radioactive Organic Waste liquids.

DESCRIPTION AND FLOWPATH

Since the Incinerator Fuel Oil and Propane Ignition Systems are designed to provide fuel oil and propane to the RK and SCC Burners, we will discuss the flowpaths of these systems during their operation.

ELO 1.03	**SKETCH the flowpath of the Incinerator Fuel Oil and Propane Ignition Systems to include:** **a. Fuel oil feed pumps flowpath** **b. RK local skid** **c. SCC local skid** **d. RK remote skid** **e. SCC remote skid**

Incinerator Fuel Oil Flowpath

The No. 2 Fuel oil storage tank is located in the clean compartment of the diked area toward the east end of the CIF Tank Farm. No. 2 fuel oil is unloaded from tanker trucks in the clean unloading area and pumped by the 110 gpm fuel oil unloading pump through a 3-inch carbon steel line to the fuel oil storage tank (See Figure 1, *Fuel Oil Unloading Station*). Fuel oil flows by gravity from the fuel oil storage tank through a 3-inch carbon steel line and duplex strainer to the suction side of the fuel oil transfer pump and fuel oil feed pumps.

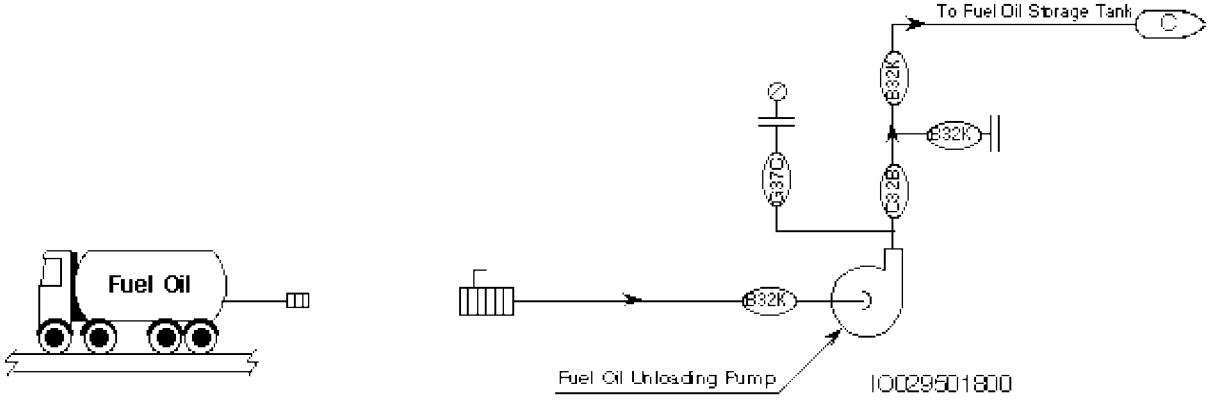

Figure 1 Fuel Oil Unloading Station

The fuel oil transfer pump can direct fuel oil via another duplex strainer to either one of the blended waste tanks and/or three flush hose stations. The flush hoses stations are located:

- Between Blend Tank No. 2 and the Aqueous Waste Tank.
- Between Blend Tank No. 1 and the Spare Tank.
- At the Rad. Oils/Solvent Unloading Area.

A 1-inch recirculation line is provided from the discharge of the transfer pump back to the fuel oil storage tank. This line prevents the fuel oil transfer pump from pumping against a "dead head" in case all of the transfer valves are closed while the pump is running (See Figure 2, *FO Storage Tank and Transfer Pump*).

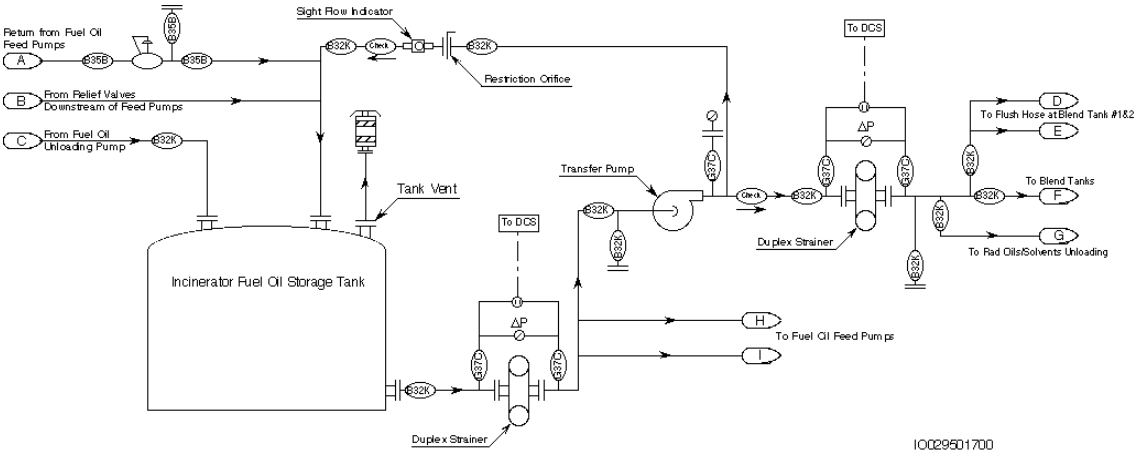

Figure 2 Fuel Oil Storage Tank and Transfer Pump

The fuel oil feed pumps supply the fuel oil burners on the RK feed head and the SCC. Pressure relief valves provided on the discharge side of each feed pump relieve back to the fuel oil storage tank, if the normal flowpath is isolated with the pumps operating. A back pressure regulating valve in the common feed pump discharge line maintains a constant pressure, currently set at 205 psig, to the remote skids by returning excess flow to the fuel oil storage tank (See Figure 3, *Incinerator Fuel Oil Feed Pumps*).

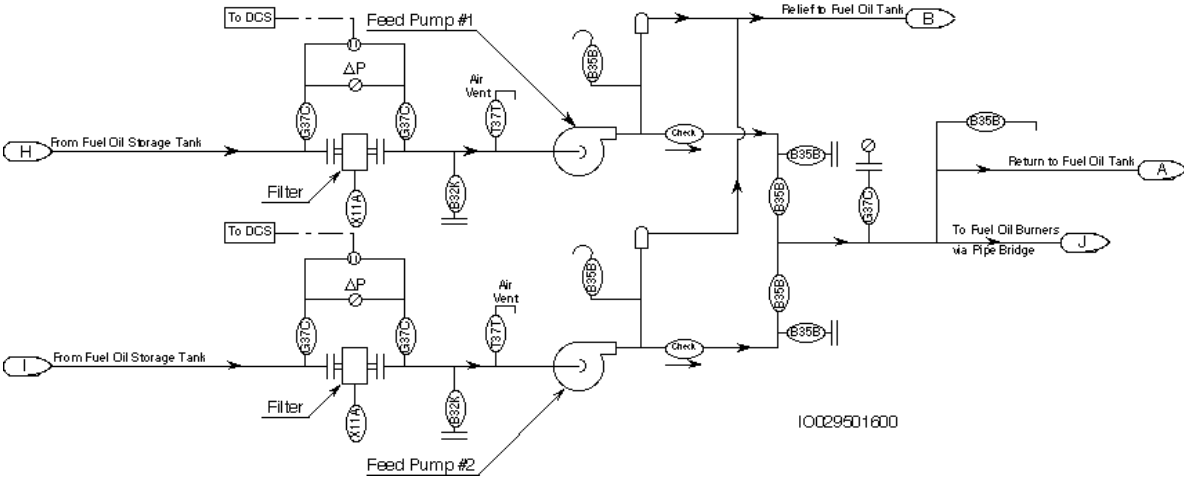

Figure 3 Incinerator Fuel Oil Feed Pumps

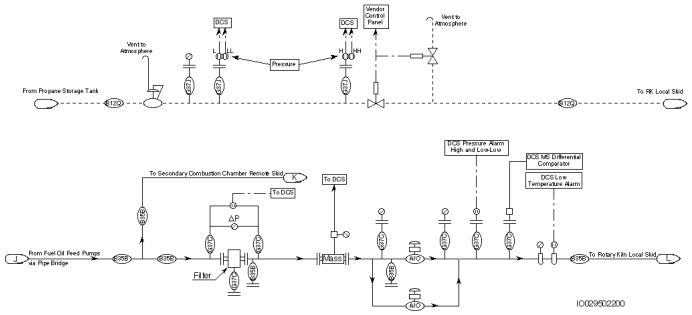

Figure 4 RK Remote Fuel Oil Skid

The fuel oil is piped to the incinerator building via the outside overhead (OSOH) pipe bridge. The line separates in the CIF building overhead, where it splits between the RK remote burner skid and the SCC remote burner skid. At the two remote skids, the fuel oil is filtered, monitored, and regulated before moving to the local burner skids (See Figure 4, *RK Remote Fuel Oil Skid* and Figure 5, *SCC Remote Fuel Oil Skid*).

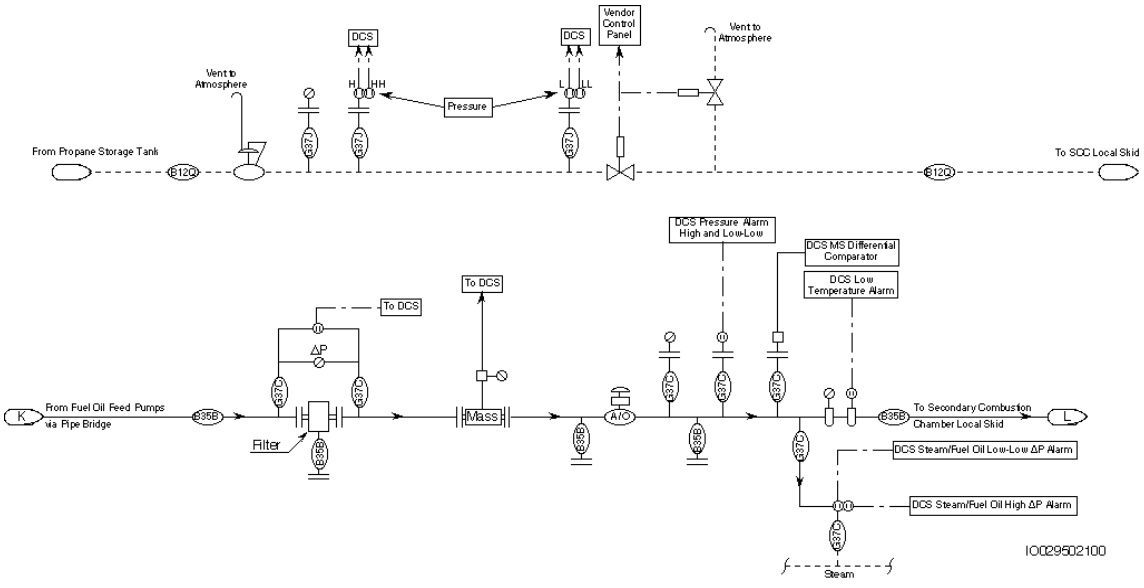

Figure 5 SCC Remote Fuel Oil Skid

The fuel oil is directed to the local skids, through the safety shut-off valves (SSOVs) and then to the respective burners (See Figure 6, *RK Local Fuel Oil Skid and Burner* and Figure 7, *SCC Local Fuel Oil Skid and Burner*).

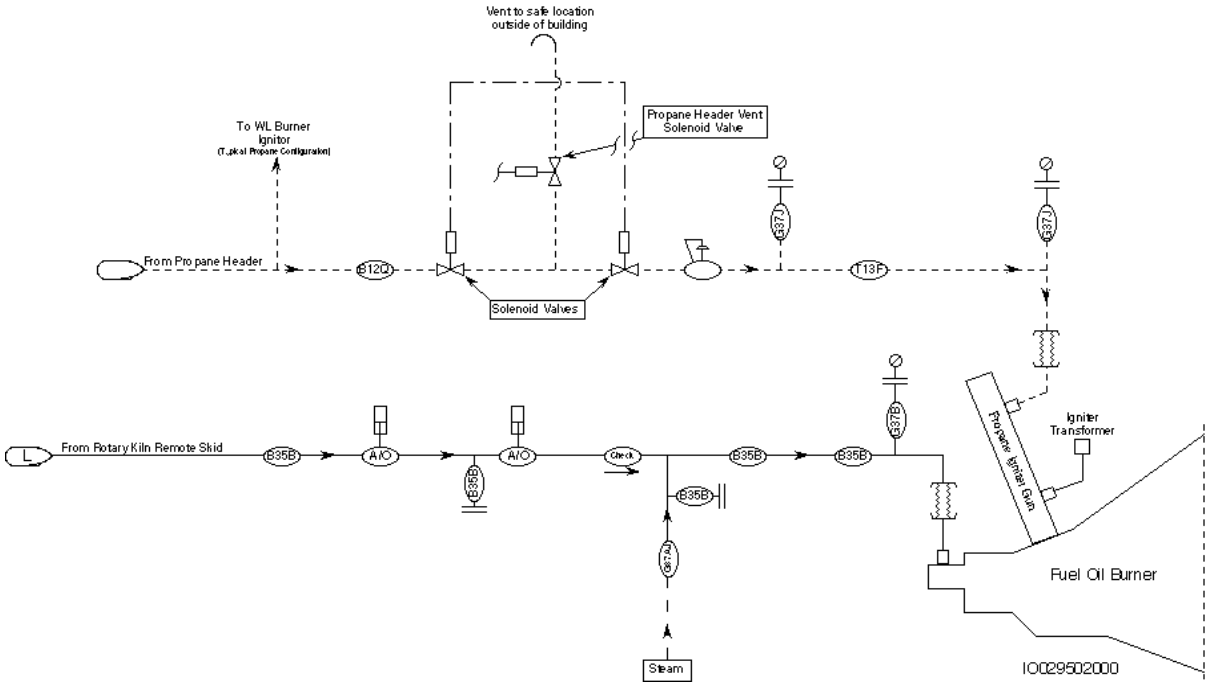

Figure 6 RK Local Fuel Oil Skid and Burner

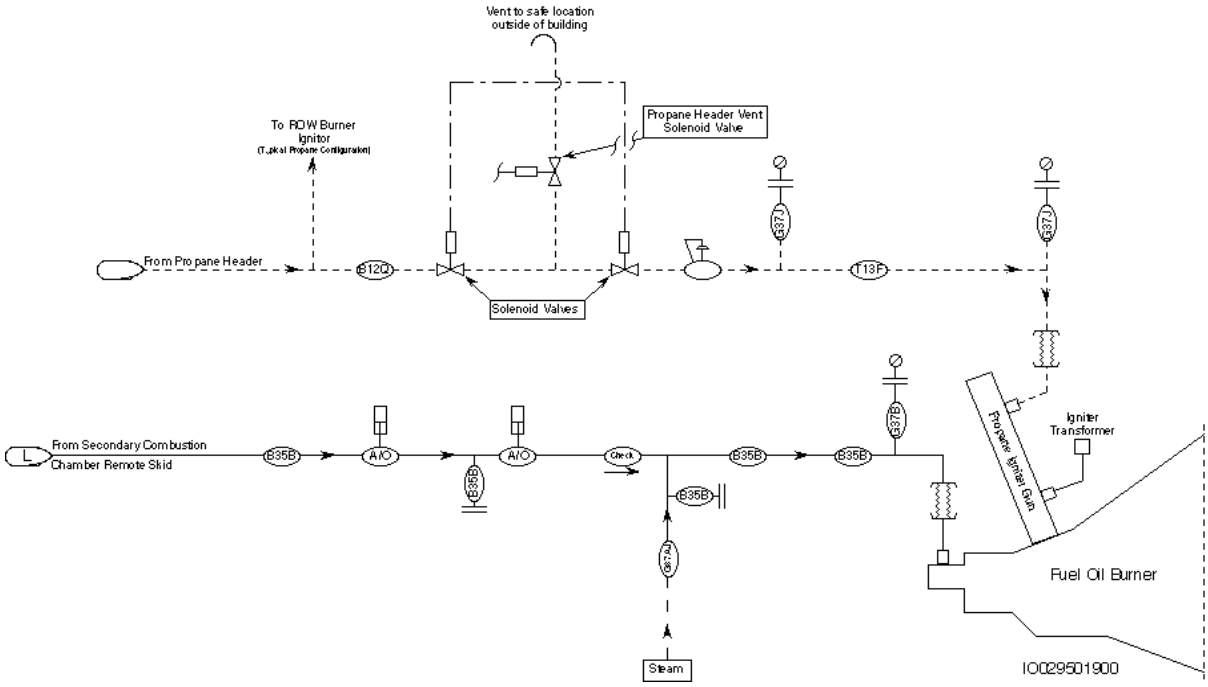

Figure 7 SCC Local Fuel Oil Skid and Burner

Atomizing steam is mixed with the fuel oil at the burner gun. Atomizing steam helps to establish an efficient fuel oil spray pattern for complete ignition. Steam also maintains the burner gun relatively cool in the high temperature environment of the incinerator. Steam is required to be admitted when the RK temperature is >1000 psig even if the burner is secured.

Propane Ignition Flowpath

Propane delivered in liquid form by tank trucks is transferred to a storage tank located north of the tank farm. The storage tank is a 500-gal. horizontal vessel. The propane leaves the tank in gaseous form and is supplied to downstream piping at 20 psig by a local pressure reducing valve. From the pressure reducing valve, the propane gas is piped, via the pipe bridge, to a RK and SCC remote burner skids (See Figures 4 and 5).

The propane pressure is reduced to 12 psig at the remote skid and is further reduced to 8 psig at the local skid prior to being supplied to the propane pilots. Solenoid isolation and vent valves are located at the remote and local skids (See Figures 6 and 7).

Since the propane storage tank pressure varies from 58 to 220 psig with changes in ambient temperature and changes in level, the tank and the pipe line upstream of the first pressure reducing valve are protected from over pressurization by two(2) pressure relief valves with a setpoint of approximately 250 psig. The pipeline downstream of the first pressure reducing valve is protected from over pressurization by a pressure relief valve with a setpoint of approximately 22 psig (See Figure 8, *Propane Ignition System*). When not in use, propane will be isolated and the downstream lines vented to atmosphere via the solenoid valves at the remote and local skids.

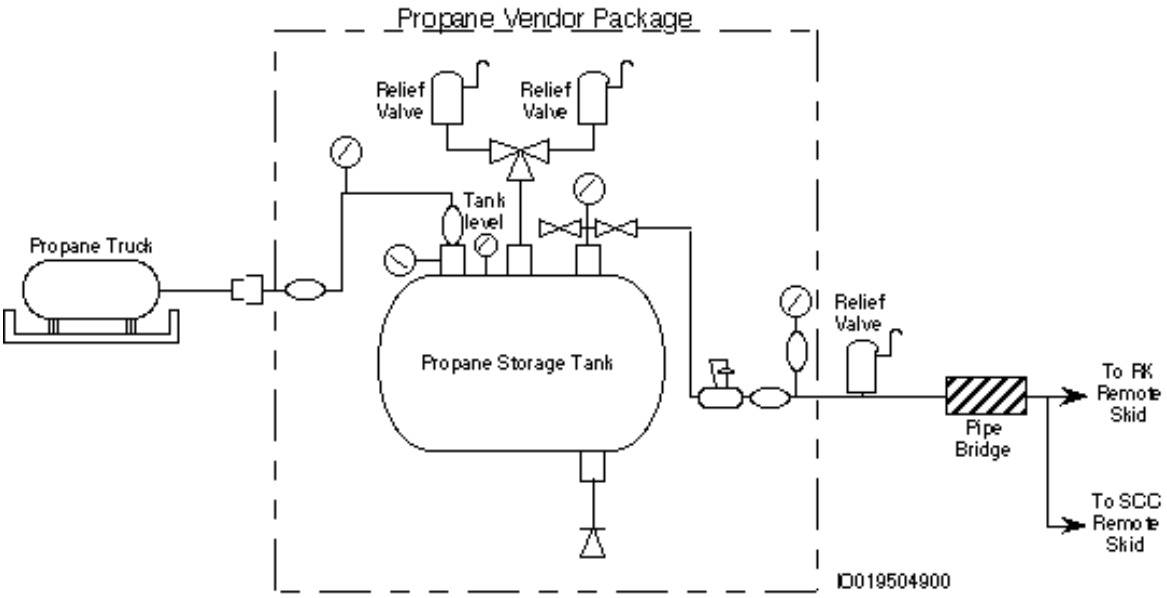

Figure 8 Propane Ignition System

The RK remote and local burner skids referred to in this text are the same as the Blended/Aqueous Waste remote and local skids referred to in Study Guide ZIOITX12/13, *Aqueous/Blended Waste*. The SCC remote skid referred to in this text is the same as the Radioactive Organic Waste (ROW) remote skid referred to in Study Guide ZIOITX14, *Radioactive Organic Waste*. The SCC local skid referred to in this text is utilized for fuel oil only.

The FO system setpoints are outlined in Table 1, *Incinerator Fuel Oil Setpoints*, and the incinerator flow and heat values are outlined in Table 2, *Incinerator Flow and Heat Values*.

CLI Number	Alarm	Setpoint
FO-LALL-0100 (A)	Fuel Oil Level LOW-LOW-LOW	27 IN
FO-LALL-0100 LA-3	Fuel Oil Level LOW-LOW	30 IN
FO-LAL-0100 LA-2	Fuel Oil Level LOW	48 IN
FO-LAH-0100 LA-3	Fuel Oil Level HIGH	168 IN
FO-LAHH-0100	Fuel Oil Level HIGH-HIGH	173 IN
FO-LAHH-0101	Fuel Oil Level HIGH-HIGH-HIGH	183
FO-PALL-1505	RK Fuel Oil Pressure LOW-LOW	5 psig
FO-PAH-1505	RK Fuel Oil Pressure HIGH	200 psig
FO-PAL-1508	RK Fuel Oil Pressure LOW	4 psig
FO-TAL-1509	RK Fuel Oil Temperature-LOW	20°F
FO-PAH-2205	SCC Fuel Oil Pressure HIGH	120 psig
FO-PALL-2205	SCC Fuel Oil Pressure LOW-LOW	30 psig
FO-PAL-2208	SCC Fuel Oil Pressure LOW	20 psig
FO-TAL-2211	SCC Fuel Oil Temperature-LOW	10°F

Table 1 Incinerator Fuel Oil Setpoints

	MAX. FLOW RATE (lb/hr)	AVERAGE HEAT VALUE (BTU/lb)
RK		
Solid Waste	900*	4,765
Liquid Waste	385	17,951
Aqueous Waste	950	2,200
No. 2 Fuel Oil	543	19,200
SCC		
Rad. Organic Waste	191	18,000
No. 2 Fuel Oil	462	19,200

* Minimum 90% Combustible

Table 2 Incinerator Flow and Heat Values

Summary

- No. 2 fuel oil is the primary fuel burned in the incinerator and used to bring the incinerator up to temperature, and to maintain the operating temperature within the required temperature band while performing waste incineration.

- Propane is used to provide the initial ignition of fuel oil burners in the Rotary Kiln (RK) and the Secondary Combustion Chamber (SCC) as well as the Blended Waste and Radioactive Organic Waste (ROW) Burners.

- The Fuel Oil and Propane Ignition Systems provide a method of accepting delivery and storage of fuel from off-site sources. This stored fuel is delivered to the incinerator at a working pressure useful to the incinerator process.

- Fuel oil is also used to increase the BTU content of blended waste and to flush incinerator facility piping.

MAJOR COMPONENTS

The Incinerator Fuel Oil System and Propane Ignition Systems consist of a storage tank, a method of transferring fuel from a transportation device using pumps, and piping and control systems to transfer the fuel to the incinerator. Safety devices, components to condition the process stream, and measuring devices are also included in the system.

ELO 1.04 DESCRIBE the equipment utilized in the Incinerator Fuel Oil System to include:

- **a. Fuel oil unloading pump**
- **b. Fuel Oil Storage Tank**
- **c. Fuel oil feed pumps**
- **d. Fuel oil transfer pump**
- **e. Strainers and filters**
- **f. Pressure regulating Valve**
- **g. Flow control valves**
- **h. Safety shutoff valves**
- **i. Burners**

Incinerator Fuel Oil System

Fuel Oil Unloading Pump

The unloading pump is a centrifugal pump rated at 110 gpm at 22 ft tdh (total discharge head) and is driven by a 1.5 hp explosion-proof motor. The unloading pump receives its power from Motor Control Center (MCC) 3.

Fuel Oil Storage Tank

The Fuel Oil Storage Tank is a 12,600-gallon carbon steel vessel with dimensions of 12 ft outside diameter by 17 ft high. The tank is designed for a maximum of 14 psig positive pressure plus static head at 200°F. The tank is vented to the atmosphere to prevent over/under pressurization during filling/draining operations. A flame arrestor is provided on the vent to reduce the possibility of a tank explosion.

Fuel Oil Feed Pumps

The two feed pumps are positive displacement, gear-type pumps, driven by 1.0 hp explosion-proof motors. Each pump is sized to supply 3.0 gpm (1,290 lb/hr) at 225 psig. This is 127% of the combined total used by the RK and SCC Burners (1,008 lb/hr). The feed pumps receive their power from MCC 3.

Fuel Oil Transfer Pump

The transfer pump is a centrifugal pump driven by a 7.5 hp explosion-proof motor. The pump is designed to provide a flow of 85 gpm at 106 ft tdh. The transfer pump receives its power from MCC 3.

Strainers and Filters

The first strainer downstream of the No. 2 Fuel Oil Storage Tank is a dual basket (duplex) type with one basket normally in service with the other basket in standby. The strainer has 0.062-inch diameter perforations used to collect weld splatter and/or trash that may be present in the storage tank. The strainer affords ample particulate protection for the fuel oil transfer pump.

The second strainer downstream of the transfer pump is also a dual basket (duplex) type with one basket normally in service with the other basket in standby. This strainer, with 0.033-inch diameter perforations, is designed to eliminate solids with particle size greater than 800 microns to minimize particles transferred to the Blended Waste Tank or the flush lines. A high pressure drop across the strainer (3 psid) will actuate an alarm (PDAW-0113).

Filters on the suction side of the fuel oil feed pumps are a self-cleaning CUNO-type with 0.008-inch spacing between filter disc and cleaner blades. This narrow spacing is necessary to prolong the life of the gear-type feed pumps. A high pressure drop across the filters (1.5 psid) will actuate an alarm (PDAH-0201 and PDAH-0203).

The filters at the remote skids are also self-cleaning CUNO-type filters. These "self-cleaning" filters require periodic manual operation of the cleaning blades during system operation to reduce the build-up on the filter. This will reduce the differential pressure across the filters by allowing the solids to fall to the bottom of the filter where they can be periodically blown down. A high pressure drop across the filters (5 psid) will actuate an alarm (PDAH-1501).

Pressure Regulating Valve

The pressure of the fuel oil to the remote skid is regulated at 200 psig by the back pressure regulating valve connected to the common feed pump discharge line.

Flow Control Valves

The fuel oil flow control valves are automatically modulated by DCS as necessary to maintain RK and SCC temperatures.

Safety Shutoff Valves

The safety shutoff valves (SSOVs) are pneumatic isolation valves located on the local skid and used to stop fuel flow to the associated burners.

Burners

Two burners are provided in the FO System; one for the RK and one for the SCC.

The RK fuel oil burner is a $10E10^6$ BTU/hr long flame gun-type burner with a maximum flow rate of 543 lbs/hr. The burner has a turndown ratio of 10 to 1 to provide for startup, shutdown, idling and modulating services to maintain incinerator thermal stability. Turndown ratio is the design flow rating of the burner to allow for a wide range of flow while still maintaining its efficiency at high and low flow rates of fuel oil. If a burner is operated above its turndown ratio, the burner could exceed its temperature limits which could cause damage to the burner. If it is operated below its turndown ratio, the stability of the burner may not be within specifications and may cause an improper fire pattern.

The SCC fuel oil burner is a $8.5E10^6$ BTU/hr vortometric high efficiency burner designed for modulating service, startup, shutdown, idling and has a turndown ratio of 4 to 1 with a maximum flow rate of 462 lbs/hr.

ELO 1.05	**DESCRIBE the equipment utilized in the Propane Ignition System to include:** **a. Propane Storage Tank** **b. Pressure regulating valves** **c. Solenoid valves** **d. Propane pilots** **e. Pilot ignitors**

Propane Ignition System

Propane Storage Tank

The tank is a 500-gal. horizontal carbon steel vessel with a maximum design pressure of 250 psig at 105°F.

Pressure Regulating Valves

The pressure of the propane is regulated by three series valves prior to entering the propane pilots. The first valve is located immediately after the propane exits the Propane Storage Tank and reduces the pressure to approximately 20 psig. The second valve is located at the remote RK burner skid and reduces the pressure to approximately 12 psig. The third valve is located at the local burner skids and reduces the pressure to approximately 8 psig.

Propane Solenoid Valves

The solenoid valves of the Propane Ignition Systems are controlled via the Burner Management System (BMS). These valves are used to start/stop flow and vent the propane. They are required in the design to satisfy burner safeguard standards as described in *National Fire Protection Standard #8502.*

Propane Pilots

Propane is supplied through the pilots to ignite the liquid waste and fuel oil burners.

Pilot Ignitors

The pilot ignitors are transformers that generate an electrical spark to ignite the propane entering the pilots.

Summary

- The FO System consists of a fuel unloading pump, a Fuel Oil Storage Tank, two fuel feed pumps, a fuel transfer pump, filters, strainers, pressure regulating valve, flow control valves, safety shutoff valves and manual valves and piping.
- The fuel unloading pump, running at 110 gpm, can transfer a full load of fuel (approx. 7,700 gallons) in about 1.5 hours.
- The fuel feed pumps each supply 3 gpm at 225 psig to the burners. A back pressure regulating valve (FO-PV-109) maintains pressure, currently set at 205 psig, to the burners steady by relieving excess pressure back to the fuel storage tank.
- The transfer pump is used to add fuel oil to blend tanks and to provide fuel oil flushing for process lines and tanks.
- The Propane Ignition Systems consists of a Propane Storage Tank, piping and manual valves, pressure regulating valves at the SCC and RK local and remote skids, solenoid valves for BMS control, and the pilots and ignitors at the burners.
- When the Propane Ignition System is not in use, the propane line is depressurized and vented to atmosphere by the solenoid valves at the remote and local skids.

INSTRUMENTATION

The instrumentation associated with the Incinerator Fuel Oil System during operation allows for monitoring from either the DCS or locally in the field.

ELO 1.06	**DESCRIBE the instrumentation used for monitoring the incinerator fuel oil system equipment operation to include:** **a. Unloading pump** **b. Storage tank** **c. Feed pumps** **d. Transfer pump** **e. Filters/strainers**

Incinerator Fuel Oil

Fuel Oil Unloading Pump

The unloading pump is provided with a local pressure gauge, with a range of 0-15 psig, to display the discharge pressure of the pump. The DCS indicates the "RUNNING" status of the unloading pump. When the pump is unloading satisfactorily, the discharge pressure will be between 8 and 10 psig. If the pump is running , but is “deadheaded,” the pressure will be between 13.5 and 14 psig.

Fuel Oil Storage Tank

The fuel oil storage tank level is monitored by the DCS with alarms at various points (See Table 1, *Incinerator Fuel Oil Setpoints*).

A temperature gauge provided at the tank allows operators to monitor the temperature of the fuel in storage.

Fuel Oil Feed Pumps

The feed pumps are monitored by the DCS for "FAILURE". The status of both pumps can also be determined by using the DCS (i.e., pump 1 running, pump 2 standby).

Fuel Oil Transfer Pump

The transfer pump is provided with a local pressure gauge, with a range of 0-60 psig, to display the discharge pressure of the pump. The DCS indicates the "RUNNING" status of the transfer pump.

Filters/Strainers

The filters/strainers used in the FO System are equipped with a local differential pressure gauge, with a range of 0-200 inwc. They each have a differential pressure alarm at the DCS which indicates a high differential pressure across the filter/strainer. The setpoint for the filters is 1.5 psid (FO-PDAH-0201 and FO-PDAH-0203) and when it is actuated, it alerts the operator to "sweep" the filter (or swap to the standby side of the duplex strainers) in an attempt to reduce the filter ΔP. The strainer ΔP alarms are 2.0 psid (FO-PDAH-0106) for the transfer pump suction strainer and 3.0 psid (FO-PDAH-0113) for the feed pumps suction strainer.

Pressure

The pressure of the fuel oil can be determined locally by pressure gauges at the following locations:

- Discharge of feed pumps prior to pipe bridge
- Inlet to flow control valve(s) on the remote RK & SCC skids
- Outlet of the flow control valve(s) on the remote RK & SCC skids

The pressure at the outlet of the flow control valves is monitored by the DCS which will alarm on a High or Low-Low value.

Fuel Oil Temperature

A local temperature gauge, with a range of -20 to 200°F, is provided at both remote skids to allow for temperature readings of the fuel oil. The DCS will also alarm on low-temperature readings at these same points.

Fuel Oil Flow

The fuel oil transfer pump recirculation flow can be monitored visually by using the sight flow glass installed in the line. The mass flow of the fuel oil from the transfer pump to either blended waste tank can be monitored locally and/or by using the DCS. A mass flow meter is also located at each remote skid for monitoring of the fuel oil flow to the local burner skids.

ELO 1.07 DESCRIBE the instrumentation used for monitoring the Propane Ignition System to include:

a. Propane Storage Tank
b. Remote RK and SCC burner skids
c. Local RK and SCC burner skids
d. Burner guns

Propane Ignition System

Propane Tank

The propane storage tank is provided with a local indication for pressure and tank level. A local pressure gauge is also provided to indicate the pressure downstream of the first pressure regulating valve.

Remote RK & SCC Burner Skids

The DCS monitors the propane pressure at the remote burner skids, downstream of the second pressure regulating valve. The DCS will alarm on the following conditions:

- Pressure to the RK and SCC High-High (19 psig) (PRIG-PSHH-2806 and PGIG-PSHH-2807)
- Pressure to the RK and SCC High (17 psig) (PRIG-PSH-2806 and PRIG-PSH-2807)
- Pressure to the RK and SCC Low (5 psig) (PRIG-PSL-2808 and PRIG-PSL-2807)
- Pressure to the RK and SCC Low-Low (3 psig) (PRIG-PSLL-2808 and PRIG-PSLL-2807)

A pressure gauge, downstream of the pressure regulating valve, is also provided for local indication at the remote skid.

Local RK & SCC Burner Skids

A pressure gauge, downstream of the final pressure regulating valve, is also provided for local indication at the local skid.

Burner Guns

A local pressure gauge is available at each burner gun to measure the propane line pressure just before entering the pilots.

Summary

- Incinerator Fuel Oil System instrumentation provides indication of:
  1. Pump status.
  2. Fuel oil storage tank level.
  3. Filter/strainer ΔP.
  4. Pressure indication at feed pump discharge, FCV inlet and outlet pressures (remote and local skids). DCS monitors FCV outlet pressures.
  5. Fuel oil temperature at the remote skids.
  6. Fuel oil flow to the fuel oil burners from mass flow meters on the remote skids and fuel oil flow to the blended waste tanks from the transfer pumps.

- Propane Ignition System instrumentation provides indication of:
  1. Propane storage tank level and pressure (local gauges).
  2. Pressure downstream of the first pressure regulator (local gauge).
  3. Propane pressure at the remote burner skids, downstream of the second pressure regulating valve (local gauges and DCS).
  4. Propane pressure at the local skid, downstream of the final pressure regulating valve (local gauges).
  5. Propane pressure at each burner gun (local gauges).

CONTROLS, INTERLOCKS, AND ALARMS

This section describes how the system is manipulated to fill the storage tank, provide fuel oil to the burners, provide fuel oil to the tanks, and flush process lines. It also describes the interlocks, conditions that actuate the interlocks, and the actions of the interlocks. This section also describes the operating limits and regulatory limits that govern operation of the Incinerator Fuel Oil and Propane Ignition Systems.

ELO 1.08	**DESCRIBE the controls associated with the operation of the Incinerator Fuel Oil and Propane Ignition Systems to include:** **a. RK fuel oil flow** **b. Fuel oil unloading pump** **c. Fuel oil transfer pump** **d. Fuel oil feed pumps** **e. SCC fuel oil flow**

Controls

Controls are provided for ignitor operation, pilot operation, burner operation, pressure control, and flow control. The pilot/burners are controlled through the BMS which consists of a control panel and an associated facility Programmable Logic Controller (PLC). The primary function of the BMS is to provide the final safety interlocking and control of the pilot/burners to prevent an unplanned/uncontrolled ignition of an explosive mixture within the Incinerator System. This includes purge logic, pre-light logic, fuel safety logic, burner startup and burner shutdown logic. All other burner control logic that is not essential for the final safety of the system is controlled by the facility PLC. For a more detailed explanation of the BMS control of the FO System, refer to ZIOITX25.01 - *Incinerator System*.

RK Fuel Oil Flow

The flow of fuel oil to the RK is controlled by the interaction of the RK temperature controller and the RK combustion air controller. The primary process control variable is temperature. Control of the RK temperature (at 1650°F) is achieved primarily by modulating fuel oil flow based on inputs from temperature-sensing devices located at the RK discharge head.

If the temperature controller demands a higher temperature in the RK, then the fuel oil and combustion air flow are increased until the temperature controller is satisfied. If the RK temperature reaches a preset high value, 60°F above the temperature set by the operator, the following actions occur:

- Fuel oil flow to the RK is gradually decreased to a low fire setting.

- If temperature is still high, the blended waste feed pump stroke is adjusted to decrease the flow of blended waste to the RK.
- Solids combustion air flow is increased.
- The ram feeder is adjusted to decrease the feed rate of solid waste.
- If the temperature reaches a low value, the following occurs:
    - Fuel oil flow is gradually increased.
    - If fuel oil flow is increased to maximum and the temperature is still low, an alarm is activated notifying the operator to manually adjust solid waste and/or blended waste flow to increase the temperature.

Both fuel oil and combustion air flow are adjusted under the direction of the temperature controller. On temperature increases, air flow increases will lead to fuel oil flow increases. On temperature decreases, fuel oil flow decreases will lead to air flow decreases.

A LO-LO temperature alarm is used to alert personnel during the extended idle mode to control the temperature around 1600°F (no waste destruction). If the temperature reaches the LO-LO-LO setpoint (1000°F), an alarm is activated and the incinerator is shut down.

The RK and SCC fuel oil burners will operate at an excess air value which is dependent upon the fuel oil flow rate. It is expected that the fuel oil burners will operate at approximately 50% excess air at minimum fire and 10 % at maximum flow rate. The atomizing steam pressure is maintained at 25-30 psig above the fuel oil pressure for the SCC burner gun and is matched with the fuel oil pressure of the RK burner up to 100 psig. Steam pressure is constant at 100 psig when RK F.O. pressure increases above 100 psig.

Fuel Oil Unloading Pump

The fuel oil unloading pump is provided with a MANUAL/OFF/AUTO (MOA) switch and controlled by the DCS.

Fuel Oil Transfer Pump

The fuel oil transfer pump is provided with an MOA switch and controlled by the DCS.

Fuel Oil Feed Pumps

The fuel oil feed pumps are provided with MOA switches and controlled by the DCS and the BMS.

SCC Fuel Oil Flow

The SCC fuel oil is controlled by the interactions of the SCC temperature controller and the SCC fuel oil burner combustion air controller. The SCC temperature control regime is identical to the RK temperature control. The flow of FO is regulated to maintain the temperature required for SCC operation.

SCC temperature is controlled by modulation of fuel oil and combustion air flow. The fuel oil is used to maintain the SCC temperature at 50°F above the low limit (1650°F) temperature. However, when the temperature reaches the High level (1962°F), the following actions occur:

- Fuel oil flow to the SCC is gradually decreased to the low fire setting.
- If the temperature is still high, the ROW feed pump is adjusted to decrease the flow of ROW.
- The damper to the tertiary air fan is adjusted to increase tertiary air flow to cool the SCC.

If the SCC temperature goes to High-High (2012°F), an incinerator emergency shut down will occur. If the temperature reaches the Low-Low level (1600°F), the following actions occur:

- The fuel oil flow is gradually increased.
- If the tertiary fan is operational, it automatically shuts off.
- If fuel oil flow is increased to maximum and the temperature is still low, an alarm is activated notifying the operator to manually adjust the ROW feed flow to increase the temperature.

The BMS is designed to control the burners in the RK and the SCC. Burner control includes air purging of the system to remove combustible gases prior to ignition, ignition sequencing for fuels and wastes, firing rates, temperature control, oxygen control, normal shutdowns, and safety shutdowns. The flow of propane is controlled by solenoid-operated valves in the supply lines for each propane burner. The propane ignitors (transformers) are controlled via the BMS. The DCS monitors the Propane Ignition System's high-or low-pressure alarms.

ELO 1.09 EXPLAIN the operation of the interlock associated with the Incinerator Fuel Oil and Propane Ignition Systems to include the interlock actuating conditions and effects, and reasons for the interlocks.

Interlocks

The fuel oil storage tank level is determined by a redundant bubbler tube arrangement using a nitrogen purge. Two bubbler tube transmitters are provided that send output to the DCS: one for indication of the

tank level and the other for indication of specific gravity. DCS alarms and interlocks associated with the fuel oil storage tank level are as follows:

- LO-LO-LO level DCS alarm and interlock, at 27 inches, to prevent operation of the fuel oil feed pumps
- LO-LO level interlock, at 30 inches, to prevent fuel oil transfer pump operation
- LO level DCS alarm only at 48 inches
- HI-HI level DCS alarm and interlock, at 173 inches, to prevent fuel oil unloading pump operation

Other interlocks associated with the Incinerator Fuel Oil and Propane Ignition Systems are:

- The atomizing steam isolation valve to the RK fuel oil burner is interlocked open when RK exit temperature is greater than 1000°F, when "Steam Purge" is selected, or when RK fuel oil is ready to be admitted. As mentioned earlier, atomizing steam helps to establish an efficient fuel oil spray pattern for complete ignition and also maintains the burner gun relatively cool in the high temperature environment of the incinerator.
- The atomizing steam block valve to the SCC fuel oil burner is interlocked open when SCC temperature is above 1000°F, when "Steam Purge" is selected, or when fuel oil is ready to be admitted. This interlock exists for the same reason mentioned above.
- Fuel oil will not be admitted to the burners if the atomizing steam is not emitted.
- Flame scanners scan for ignition during initial start-up. If a flame is not detected within the time limit of 10 minutes, a re-purge of the system must be performed.
- If flame scanners do not detect a flame on the propane pilot within 10 seconds of the start of the ignition, the propane solenoid valves are closed.
- If flame scanners do not detect ignition of the fuel oil burner within 15 seconds of the start of the ignition, the fuel oil flow control valves will close.

- If the designated combustion air fan is lost, the fuel flow will be shut off by the flow control valves.

Emergency Off (C043)

The Emergency Off Interlock (C043) is interlocked with the fans, pumps, burners, nozzle and incinerator equipment through the BMS to prevent operation of associated equipment until the affected controller is reset. This is used if there is a situation which could threaten the Incinerator and its safety and all fire to the Incinerator must be secured.

Mandatory Off (C044)

The Mandatory Off Interlock (C044) is interlocked with the fans, pumps, burners, nozzle and incinerator equipment through the BMS to prevent operation of associated equipment until the affected controller is reset. This is used if there is a situation in which parameters must be changed which requires adjusting feed rates, to return to permit limits, for example.

Limits

During normal operation, the maximum heat load for the RK is 15×10^6 BTU/hr, and 18×10^6 BTU/hr for the incinerator system. These are Resource Conservation and Recovery Act (RCRA) permit limits, and combined feeds (including the fuel oil) will be controlled to prevent exceeding them.

The maximum allowable temperature for the refractory in the RK and SCC is 2800°F. The maximum internal design pressure for the RK and SCC is 15 psig. Again, combined feeds (including the fuel oil) will be controlled to prevent exceeding them.

To prevent damage of the burner guns, the atomizing steam must be in service to the fuel oil burners when the incinerator temperature is 1000°F or greater. For a further explanation of damages refer to Study Guide ZIOITX25.01, *Incineration System.*

Propane ignitors (transformers) are controlled via the BMS.

The fuel oil storage tank level is determined by a bubbler tube arrangement using the nitrogen purge.

Summary

- Controls are provided for ignitor operation, pilot operation, burner operation, pressure control, and flow control.

- Fuel oil flow to the RK is controlled by the interactions of the RK temperature controller and the RK combustion air controller.

- Fuel oil pumps are provided with MOA switches for local and remote control.

- Fuel oil flow to the SCC is controlled by the interactions of the SCC temperature controller and the SCC fuel oil burner combustion air controller. The SCC temperature control regime is identical to the RK temperature control.

- Burner control includes air purging of the system to remove combustible gases prior to ignition, ignition sequencing for fuels and wastes, firing rates, temperature control, oxygen control, normal shutdowns, and safety shutdowns.

- Interlocks are devices, either mechanical or software, that automatically carry out a single, predetermined function when a defined event occurs. The FO system uses interlocks to:

    1. Shut down all FO feed pumps and transfer pumps on low level and shut down the unloading pump on high level.

    2. Open the atomizing steam valve when RK or SCC temp exceeds 1000°F.

    3. Prevent fuel flow to a burner unless the atomizing steam valve for that burner is open.

    4. Close fuel oil control valves and propane solenoid valves unless a flame is detected at the burner (there is a time delay of 10 seconds at ignition to allow the burner to start up)

    5. Cut off fuel flow if the designated combustion air fan is lost.

    6. Require a repurge of the system if the burner fails to ignite within the time limit imposed by the flame scanner circuit.

- Limits are designated by the manufacturer based on the physical capabilities of the equipment or regulatory. This section lists limits on:

    1. Maximum heat load: RK, 15×10^6 BTU/hr; Incinerator System, 18×10^6 BTU/hr

    2. Maximum refractory temperature: 2800°F

SYSTEM INTERRELATIONS

This section lists CIF systems that are required for the Incinerator Fuel Oil and Propane Ignition Systems to operate effectively.

ELO 1.10	**EXPLAIN how the Incinerator Fuel Oil and Propane Ignition Systems interrelate with the following equipment/systems:** **a. Rotary Kiln** **b. Secondary Combustion Chamber** **c. Steam System** **d. Distributive Control System and Burner Management System** **e. Tank Farm** **f. Instrument Air System** **g. Nitrogen System**

Rotary Kiln

The FO System supplies fuel oil to the RK by means of feed pumps, piping, and other associated equipment. The fuel oil is introduced to the RK through a burner assembly.

The Propane Ignition System is used for the initial ignition of the burners of the RK.

Secondary Combustion Chamber

The FO supplies fuel oil to the SCC by means of feed pumps, piping and other associated equipment. The fuel oil is introduced to the SCC through a burner assembly.

The Propane Ignition System is also used for the initial ignition of the burners of the SCC.

Steam System

The Steam System is utilized to atomize the fuel oil prior to introduction for burning. This atomization is necessary to permit an equally distributed flame. Steam is also used to maintain the burners cool when incinerator temperatures are above 1000°F. Steam can also be aligned to the fuel oil burners for clean out following shutdown.

DCS and Burner Management System

The DCS and Burner Management System electronically control and monitor the system to ensure the proper operation.

DCS maintains the temperature of the RK and SCC at setpoint by modulating the fuel oil supply and combustion air flow.

The Burner Management System is utilized to control the Propane Ignition System and burner safety.

Tank Farm

The No. 2 Fuel Oil Storage Tank is located in the Tank Farm Area. (See Figure 9, Tank Farm Layout.)

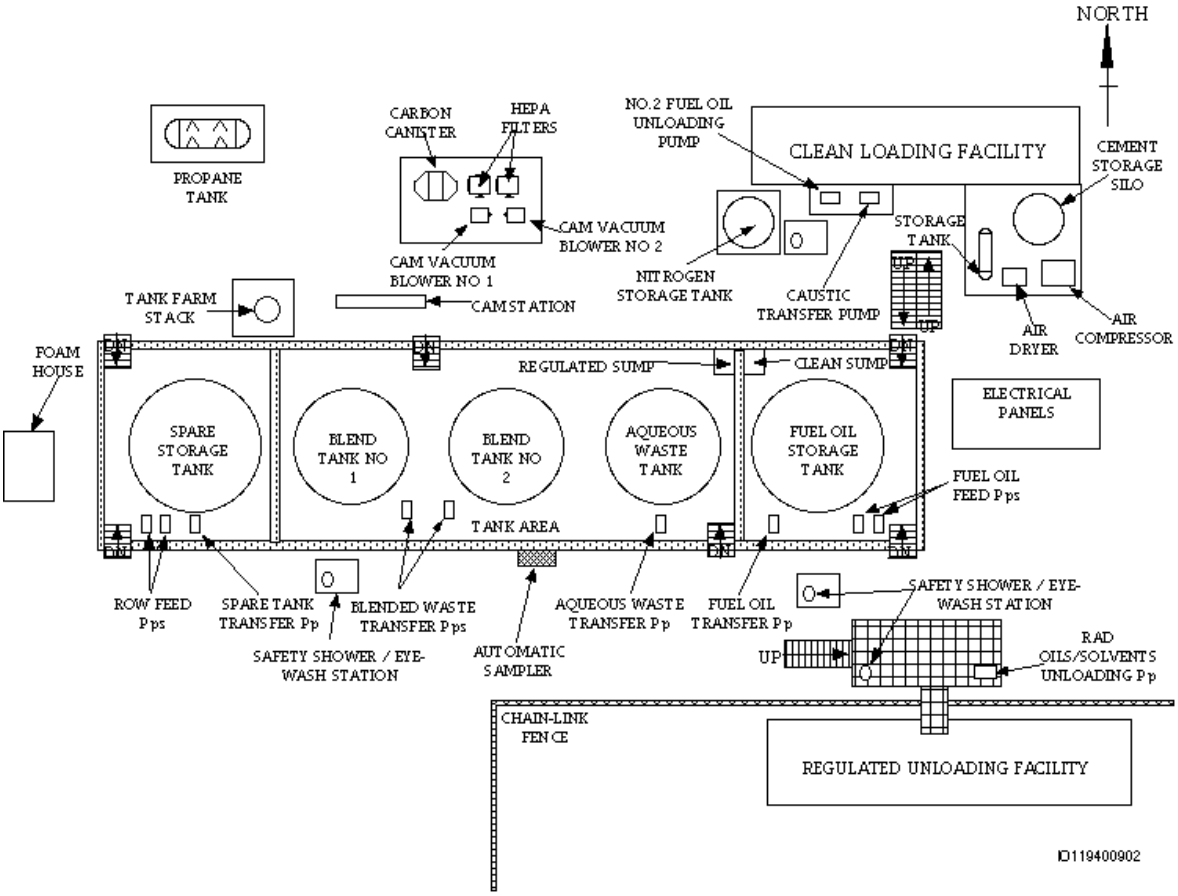

Figure 9 Tank Farm Layout

Instrument Air System

The instrument air system is used to operate the pneumatic fuel oil flow control and safety shutoff valves.

Nitrogen System

The fuel oil storage tank level is measured by a redundant bubbler tube arrangement using a nitrogen purge.

Summary

- The FO System supplies fuel oil to the RK and SCC. Additionally, it supplies oil to the blended waste tanks and for flushing piping and tanks.
- The FO System is supported by the Steam System, which supplies steam for atomizing fuel in the burner and for cleaning the burner.
- DCS and BMS provide controls for both of the systems.
- The Instrument Air Systems provide motive power for flow control and safety shutoff valves.
- The FO System is also supported by the Nitrogen System, which supplies pressure for the tank level (bubbler) indication.

INTEGRATED PLANT OPERATIONS

Normal operation describes steps taken during startup, operation phase and shutdown. Pre-start conditions list conditions that must be met to enable permissive circuits. Criteria for normal and mandatory shutdowns are listed.

Infrequent operations are operations that occur rarely or perhaps never. Flushing system piping may be one such operation. Equipment or administrative failures can cause an abnormal condition to exist. If the incinerator is operating in an unsafe manner, or equipment reliability is seriously degraded by these circumstances, the plant shall be shut down per approved procedures.

ELO 1.11	**DESCRIBE normal operations of the Incinerator Fuel Oil and Propane Ignition Systems to include:** **a. Startup** **b. Rotary Kiln operation** **c. Secondary Combustion Chamber operation** **d. Normal shutdown** **e. Mandatory shutdown**

Normal Operations

Startup

For initial startup of the incineration process, the Incinerator Fuel Oil and Propane Ignition Systems must be properly aligned for operation per procedures 261-SOP-FO-01 and 261-SOP-PRIG-01, respectively. If an initial startup of the incinerator is to be performed, all systems necessary to support incinerator operation are in service as directed by the 261-GOP-01, *Process Startup From Cold Standby To Warm Standby* and 261-GOP-02, *Process Startup From Warm Standby To Normal Operations*.

Before a startup operation can be performed, the following conditions of the system must be met:

Rotary Kiln

- Fuel oil flow control valves in Low fire position
- Fuel oil pressure not Low-Low
- Fuel oil atomizing steam pressure not Low
- Waste liquid safety shutoff valves closed
- Fuel oil safety shutoff valves closed
- Fuel oil steam purge valve closed
- Fuel oil gun position OK
- Propane pressure not High-High

- Propane pressure not Low-Low
- Aqueous waste safety shutoff valves closed

Secondary Combustion Chamber

- Fuel oil flow control valve in Low fire position
- Fuel oil atomizing steam DP not Low
- Fuel oil safety shutoff valves closed
- Rad. organic safety shutoff valves closed
- Fuel oil steam purge valve closed
- Fuel oil gun position OK
- Propane pressure not High-High
- Propane pressure not Low-Low

For initial startup, a system purge will be performed first. This process involves the RK fuel oil combustion air fan, RK solids combustion fan, SCC fuel oil combustion air fan, seal cooling fans (for air to the RK seals only), induction fans, fuel oil feed pump #1, and the solids combustion air valves. At the end of the purge cycle, the RK and SCC combustion air will be set to 25% excess air for low-fire start. Also, at the end of the purge cycle, the purge valid timer starts, which specifies that an ignition must be established within 10 minutes of the purge. If an ignition is not established, then the system (incinerator) must be purged again.

The RK fuel oil burner will be lit first. When the "Start RK-FO" pushbutton (DCS) is pressed, the following actions occur:

- 10-second ignition trial for propane pilot starts.
    - Pilot timer starts.
    - Ignition transformer is on.
    - Pilot gas (propane) vent valves close and shutoff valves open.
    - Pilot ignites.
    - Flame scanners detect flame.
    - Ignition transformer is de-energized.
- The pre-main flame steam flow is established
    - Atomizing Steam valves open unless already open (atomizing steam valves will be open already if RK temperature is above 1000°F).
- 15-second ignition trial starts for main burner flame.
    - Fuel oil safety shutoff valves open.
    - The main burner flame timer starts.
    - Main flame ignites.

- Pilot gas (propane) shutoff valves close and vent valves open.
- Fuel oil flow control valve released from low fire setting for setting of desired flow rate.

The steps just listed are typical for the SCC fuel oil burner ignition as well. The SCC burner is ignited second, after the SCC refractory bricks have heated to 600 °F. Once the RK and SCC fuel oil burners are ignited, the ramp-up procedure will be started to raise the RK and SCC temperatures to the normal values. The fuel oil flow and the solids combustion air are modulated to maintain the ramp-up temperature.

For the startup of the process, the refractory insulation for the incinerator must be heated in a slow and controlled manner. Initial cure-out and a controlled incinerator heat-up rate are utilized to prevent thermal stress and/or contained moisture from damaging the refractory bricks of the kiln. The RK and SCC should be heated up according to the time and temperature schedule below.

STEP	TEMPERATURE (°F)	RAMP RATE/HOLD TIME	ELAPSED TIME
1	< 200°F	5.0°F/Hour	4 Hours
2	<300 ≥ 200	10°F/Hour	10 Hours
3	Hold at 300°F	12 hrs W/O refractory cure 24 hrs W/refractory cure	24 Hours
4	≥300°F <600°F±100°F	100°F/Hour	3 Hours
5	Hold at 600°F±100°F	12 hrs W/O refractory cure 24 hrs W/refractory cure	24 Hours
6	≥600°F ≤1200°F	100°F/Hour	6 Hours
7	Hold at 1200°F±100°F	6 Hours	6 Hours
8	Temp. ≥1200°F & Setpoint >1200°F	Ramp To Setpoint +100°F at 100°F/Hour for RK 150°F/Hour for SCC	4 Hours
9	Hold at Setpoint +100°	6 Hours	6 Hours
10	Return to Setpoint	-100°F/Hour	1 Hour

Table 3 Incinerator Hold Points and Ramp Rates

If the unit has been shutdown for any length of time, the following schedule should be used to prevent excessive damage to the refractory.

EXTENDED SHUTDOWN	One month or longer - Complete cure-out according to the heatup table.
MODERATE SHUTDOWN	One week to one month - Raise temperature from ambient to 300°F at 50°F/hour. At 300°F follow steps 2 through 9.
SHORT TERM SHUTDOWN	Less than one week - Raise temperature from ambient to 300°F at 100°F/hour. At 300°F follow steps 2 through 9.
SYSTEM TRIP	$\geq$1200°F raise temperature 300°F/hour or 200°F/hour if temperature falls below 1200°F. There are no hold points during the recovery from a system trip.

If system has cooled, restart ramp at nearest holding temperature below current temperature.

The SCC ramp controller* SETPOINT shall be 1800°F while running and 1200°F while idle.

The RK ramp controller* SETPOINT shall be 1600°F while running and 1200°F while idle.

Table 3 Incinerator Hold Points and Ramp Rates (Cont.)

*For more information on the SCC and RK ramp controllers, see Study Guide ZIOITX25.01, *Incinerator System (RK, SCC, BMS)(U).*

Normal Operation

When the Incinerator System is at operating temperatures, the fuel oil and air will be modulated to maintain the pre-set temperature. The RK and SCC will be ready for waste when the permissive temperatures are reached (RK>1400°F; SCC>1800°F). The sequence of actions described for the ignition of the fuel oil burners is also typical for the waste burners.

The maximum flow rate of fuel oil from the fuel oil storage tanks to the RK and SCC is governed by the maximum capacity of the fuel oil feed pumps and the maximum capability of the burners to accept fuel oil. The minimum flow of fuel oil from the tank farm to the RK and SCC is dependent on the turndown ratios of the burners. The turndown ratios and resulting minimum flows are listed below.

BURNER	Turndown Ratio	Maximum Flow	Minimum Flow
RK Fuel Oil Burner	10:1	543 lbs/hr	54 lbs/hr
SCC Fuel Oil Burner	4:1	462 lbs/hr	116 lbs/hr

Table 4 Burner Specifications

The Incinerator Fuel Oil System is used during normal operations of the RK and SCC to maintain appropriate operating temperatures. The RK exit gas temperature must be ≥1400°F, and the SCC exit gas temperature must be ≥1600°F. These temperatures are set to ensure complete thermal destruction of the waste material and to prevent the carryover of any combustibles.

Filling Fuel Oil Storage Tank

The Fuel Oil Storage Tank will need to be filled approximately every three (3) days. A fuel oil delivery should be ordered when the tank level is about 62 inches, which is equivalent to 4400 gallons in the tank. The fuel oil will normally be delivered in a 7700-gallon tanker to the Clean Unloading Area at the east end of the Tank Farm. The fuel oil must meet certain requirements before it can be accepted as discussed in SOP-FO-02, *Fuel Oil Storage Tank*: fuel oil gravity is between 28 and 38, sulfur content is no more than 0.29%, the PO number that is provided by the SS is the same number that appears on the vendor documentation, and the trailer number on the Bill of Laden matches the number on the trailer.

After securing and grounding the truck, a connector hose is used to link the truck to the 3-inch bronze coupler on the fuel oil unloading pump suction piping. This coupling is an aviation camlock coupling with an internal, spring-loaded check valve. The fuel oil unloading pump will be used to unload the fuel oil from the tanker, not the pump on the tanker, due to the discharge pressure of the tanker pump exceeding the design pressure of the fuel oil system piping.

If the system operates correctly, the fuel transfer will be shut off when the DCS receives a HIGH signal at the storage tank. If the unloading pump does not automatically stop at the HIGH level, the operator should manually stop the pump. The pump should also be stopped if the fuel tanker empties prior to receiving the HIGH-level indication or if any leaks are detected in the system.

Once the transfer is complete, the pump is set to the "MANUAL" position and the initial setup process is reversed to disconnect the tanker from the unloading configuration.

Infrequent Operations

ELO 1.12	**EXPLAIN the consequences of abnormal operations associated with the Incinerator Fuel Oil and Propane Ignition Systems.**
ELO 1.13	**Given a scenario illustrating a failure of one or more support systems associated with the Incinerator Fuel Oil and Propane Ignition Systems, DETERMINE the impact on the system operations, and DESCRIBE responses and mitigating actions.**

The Propane Storage Tank, on occasion, will need to be filled also. Propane will be delivered to the Propane Storage Tank. The Propane Storage Tank is located outside the Tank Farm diked area north of the service road running north of the CIF main building. The operator should verify that all paperwork is correct and complete before the propane is transferred. After securing and grounding the truck to prevent the chance of creating a spark due to static discharge, the vendor will transfer the liquid propane to the storage tank.

Abnormal Operations

Abnormal conditions may result in the shutdown of an individual burner or the incineration system (emergency shutdown). The propane and fuel oil isolation valves are designed to fail closed on loss of air/power (propane vent valves fail open). A valve that fails closed would shutoff the fuel supply to the RK and SCC and prevent the buildup of a potentially explosive atmosphere within these components. The RK and SCC valves are pneumatically-operated valves that require air pressure to keep them open. The propane valves are solenoid valves. Upon loss of power or instrument air, these valves automatically close.

There are no adverse environmental conditions identified under which instrumentation for the FO System must remain functional. An abnormal environmental condition may lead to a partial or total loss of instrumentation controlling the fuel systems and its major components. CIF activities would be brought to an orderly shutdown if the FO system operation were suspended.

There are three (3) modes of shutdown of the incinerator; Normal, Mandatory, and Emergency. Each form of shutdown is governed by the situation and events causing the action.

Normal Shutdown

A normal shutdown of the incinerator is a pre-planned activity and is not a response to a critical malfunction or failure of an incinerator component. A normal shutdown of the incinerator will be achieved by execution of approved operating shutdown procedures.

Mandatory Shutdown

A mandatory shutdown is caused by a failure in one of the components of the Incinerator or its support equipment. A mandatory shutdown involves the removal of an individual waste burner from service or complete incinerator shutdown, depending on the type of problem or situation involved. A shutdown of this type will be achieved by execution of approved operating shutdown procedures.

Emergency Shutdown

An emergency shutdown results in the termination of fuel oil, waste flow, combustion air flow, and atomizing steam flow to the incinerator. The emergency shutdown is initiated manually:

- Operator-initiated shutdown by pressing Emergency Shutdown Pushbutton at BMS

- Operator-initiated shutdown by pressing Emergency Shutdown Pushbutton at DCS panel in the Control Room

- Operator-initiated shutdown by toggling switch D-2 on Point Tag Display INC1709E-1. (Reset is switch D-1 on Point Tag Display INC1709E-1.)

Infrequent operations for the Incinerator Fuel Oil System will consist of responding to the various DCS alarms. Alarms and their required actions (ARPs) will be available to the operator by using the DCS graphical and group faceplates.

Upon a loss of normal power, the instrumentation in the BMS and the DCS/PLC is provided with backup power from the UPS. This allows the BMS and the DCS/PLC to function until the emergency diesel generators that supply power to MCC 7 and MCC 8 are started.

BMS Permissive Trip

BMS Permissive Trips are initiated automatically when permissive setpoints are satisfied. The conditions and DCS Point Tags that display the instrument that provides the input to the Permissive circuit are listed in ZIOTX25.01, *Incineration System (RK, SCC BMS) (U).*

BMS Permissive Trips shut the incinerator down when a monitored parameter exceeds the incinerator safe operating condition, or equipment availability does not support safe operation of the incinerator. The Permissive Trip initiates a waste feed and fuel oil cutoff. If a condition exists which should have resulted in a BMS Permissive Trip, then the operator shall initiate an Emergency Shutdown.

Summary

- The Incinerator Fuel Oil and Propane Ignition Systems are aligned for operation per procedures 261-SOP-FO-01 and 261-SOP-PRIG-01, respectively.

- Permissives prevent operation of the incinerator until the proper conditions are present to safely operate the incinerator.

- For an initial startup of the Incinerator System, the RK is lit off first. The SCC is a crossfired incinerator; the burner heat is directed toward the opposite wall of the incinerator due to the placement of the burner. The refractory bricks must be preheated to 600°F to prevent damage.

- Bringing the refractory brick to operating temperature in a controlled manner minimizes thermal stress across the incinerator components. Holding temperature constant for a period of time allows moisture to be driven off.

- Normal shutdowns are performed as a preplanned activity. They are performed according to approved operating procedures.

- Mandatory shutdowns are performed due to a failure in one of the components of the incinerator or its support equipment. This type of shutdown is performed according to approved operating procedures also.

- Infrequent operations consist of normal, preplanned activities that occur on an infrequent or irregular basis, such as filling of the propane and fuel oil storage tanks.

- Abnormal operations can be broken down to Mandatory Shutdowns and Emergency Shutdowns. Mandatory Shutdowns occur due to equipment necessary for the safe operation of the incinerator not being available. Emergency Shutdown is manually initiated by the operator when a condition exists that should have resulted in a BMS permissive trip, Waste Burner Only Trip, or Mandatory Shutdown.